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CHINA'S DIESEL PRODUCTION

China's rolling stock manufacturing industry has been making a flying development since the liberation. During the national economy recovery period between 1949 and 1952, while the existing small number of repair plants were restored and the repair of engines and cars advanced, planned designing and trial manufacturing began. The imitative "Chieh-fang" (Liberation) model steam engine was made in September 1951, and the original "Ho-p'ing" (Peace) model steam engine was designed and constructed in October 1956. Thus, China redeemed herself from the backward condition. By the time when the second five-year plan began in 1958, the trial manufacturing of diesel engines, including the "Chien-she" (Construction), the "Hsien-hsing" (Forerunner), the "Chu-lung" (Giant Dragon), and the "Wei-hsing" (Satellite), succeeded. Their descriptions are as follows.

"Chien-she" Made by the Ch'ang-hsing-tien rolling stock repair plant in September 1958; electric power transmission; 600 hp; empty weight 60 t; maximum speed 85 Km/hr; all parts produced domestically.

"Hsien-hsing" Made by the Ch'i-shu-yen rolling stock plant in April 1959; electric power transmission; 2,000 hp; maximum speed 120 Km/hr; cruising range over 1,000 Km; 96.2Km/hr when hauling 10 passenger cars. The engine, a joint effort of the Wu-hsi diesel plant, the Shanghai diesel plant, the Szu-fang rolling stock plant, and the Wu-hsi rubber plant, is the 1,000 hp 12 v Fei-lung brand, water cooling 4-cycle, supercharger attached, 1,500 r P m 2-motor loading.

"Chu-lung" Made by the Dairen rolling stock plant in September 1958; for freight; electric power transmission; 4,000 hp; overall length more than 33 m; 2-vehicle composition; two 2,000 hp diesels, run by 1,350 KW motor; thermal efficiency 28%; hauling capacity 3,500 t; speed 100 Km/hr; cruising range 800 Km.

"Wei-hsing" Made by the Szu-fang rolling stock manufacturing plant in November 1959; hydraulic power transmission; 2,000 hp; speed 140 Km/hr.

The Mass Production of the Three Types of Engines

Recently, the Dairen rolling stock plant and other units have been mass producing three types of diesel engines which are running on China's railways. They are the 2,000 hp electric power transmission diesel for passenger and freight on main lines, the 1,200 hp

electric power transmission diesel and the 600 hp hydraulic transmission diesel, both for shunting and for plants and mines. Since May 1964, these diesel engines have been in trial operation on the Ching-pao (Peiping - Paotow) and Ching-ch'eng (Peiping - Ch'eng-te) lines. Some of them, after 35,000 Km, have been shown to be basically excellent in function. While they are not summit products, their construction is fairly mature, and they are reliable models for transportation.

The Diesel Engine

The diesel engine was created in the 1920's. In the 50's, the industrial nations in the world, one after the other, stopped making steam engines and switched to diesel or electric engines, especially the United States, which, since the end of World War II, has been using almost entirely electric diesel engines. This is also true with the express trains on Japan's Tohoku line. China is attempting to catch up with the world tendency and aiming at the early diesel-ization and electrification of her railways. With the rapid development of the petroleum industry in recent years, which furnishes a favorable condition for railway diesel-ization, the mass production of diesel engines has become possible.

What are the strong points of the diesel engine which attract the special attention of China? The following is some information gathered from newspapers and periodicals.

First, compared with the steam engine, the thermal efficiency of the diesel is remarkably superior. The thermal efficiency of the steam engine is 7% while that of the diesel reaches around 28%. Next, as the readying time is shorter, the start and acceleration fast, and the operation speed much greater, the transit capacity of the diesel for the same line is at least 25% greater; a run between Peiping and Canton will require only around 20 hours. Its transport cost is estimated to be 30% to 35% cheaper than the steam engine. One supply of fuel and water will enable it to haul thousands of tons of freight over 800 to 1,000 Km without interruption. Thus, it is suitable for operation through areas without water and coal, mountains with steep grades and long tunnels, forests, oil field zones, etc., where the use of the steam engine is impractical. When new lines are constructed, as coal and water supply facilities are unnecessary, the construction equipment can be cut in half, 20 million yuan saved for every 1,000 Km, and the construction time shortened. With the diesel, the working conditions of the train crew will be greatly improved, and 10,000 or more train and maintenance men dispensed with for every 1,000 diesel engines. The greatest advantage of the diesel engine is the great economy of superior coal. According to statistics, 1,000 steam engines consume around 3.5 million tons of coal a year. By combined utilization, besides producing

coal gas, the coal so saved can be made into 260,000 t of tar and over 10,000 t of nylon. Equivalent to over 300,000 piculs of cotton, the nylon will solve the clothing need of over 10 million people. Such is the important significance of diesel-ization on the general development of China's national economy.

Adopting Sturdy Models and Concentrating Forces

In 1961, the Railway Ministry decided to make diesel engines. In barely three years since then, the trial manufacturing of large hp diesels succeeded and their mass production began. That this power revolution of railway transportation was possible was due to the application of Chairman Mao Tse-tung's strategic thinking of concentrating superior forces for a wipe-out battle by China's industrial departments. The main strength of this wipe-out battle was the rolling stock plants of the railway departments. In addition, other railway, machinery, metallurgical, and chemical industrial plants, totalling over 100 units from 9 departments, and more than 10 scientific research units and universities participated. The Railway Ministry organized a diesel engine small directing team. They closely cooperated on production, technology, and scientific research, followed the principle of self-revitalization and arduous struggle, made use of the old equipment, and succeeded in creating a new product.

The heart of the locomotive is the diesel engine. There was much argument about the model to be selected. The essence of the argument was whether to start from the practical, select first a steady and solid model, and improve it afterward, or whether to depart from the practical and seek the advanced level still under study. In the end, in view of China's current industrial level and railways, large hp medium speed diesel engines, which would not be the world's most advanced products, but mature in structure and reliable, belonging to the medium-high class from the economic norm standpoint, were decided on. Superior forces were concentrated to fight for ground, attempt at early mass production, and satisfy the need of railway construction. With the training and experience thus acquired as the springboard, they would undertake the study of new products and catch up with the world advanced level. The foregoing was the unanimous conclusion reached by the leadership cadres, technicians, workers, experts, and professors of plants, schools, scientific research organs, and use units concerned after repeated discussions. This policy was proven to be correct by subsequent events. The selection of models suitable to the current conditions and the early success of their trial manufacturing would create the conditions for the mass production of diesel engines, and pave the way for the trial manufacturing of the newest models of the 60's during the third five-year plan period. While it might look like a detour, it was actually the fastest way.

Encircling Attack of the Ten Crucial Points

Compared with the steam engine, the diesel engine is much more complex in structure, requiring over 70,000 large and small parts, over 30 kinds of alloy steel, hundreds of thousands of processes, high precision, and combined technology. For example, the engine body is welded from over 300 steel plates of different thickness and size. The total length of the welding seam is 850 m, and the variation after welding must not exceed 3 mm. On the other hand, China's railway plants were almost entirely old establishments of 40 to 50 years, with antiquated machineries, and without special equipment or manufacturing experience. Most of the technicians and workers had never studied the diesel engine, and some of them had never even seen one.

While gathering forces for a wipe-out battle in the manufacturing of engines, the small directing team of the Railway Ministry concentrated on the complex and crucial parts and tackled them one by one. For example, when the trial manufacturing of the high hp medium speed diesel engine began, for a time 4 plants were making engines of the same model simultaneously, on ground that it was a sure method. However, the progress was slow. Upon investigation, it was discovered that there was overlapping labor, and the strengths were actually dispersed. Thereupon, the plants got together, analyzed the diesel engine, and picked out 10 crucial parts and 80 barriers. As many of them involved new technology and new processes never before tackled, it would take a long time if all of them were undertaken by one plant. For example, as the large aluminum castings, such as the air-sweep pump, required high precision, plants known for the quality of their casting were asked to study them, and those experienced in making precision parts for steam engines, such as cylinder blocks, oil nozzles, oil pumps, speed regulators, precision electrical appliances, and measuring instruments, and those experienced in making railway electrical signal instruments were asked to trial manufacture them. In the process of attacking the technical key points, the small directing team organized the researchers of more than 10 scientific research institutes, universities, and special schools. In connection with their special assignments, they were sent to the plants concerned, to struggle together with the technicians and workers of such plants. By so doing, their goal became concrete and clear, and result was rapidly produced.

The Installation of the Engine Workshop in the Dairen Rolling Stock Plant

The plants in charge of making the diesel engine and parts picked the highly skilled workers and technicians and good equipment

port in all things needed for the diesel engine. The iron and steel plants of the various areas delivered the more than 30 kinds of alloy steel needed for the diesel engine on schedule and according to the specified quality and quantity.

Though pressed by their regular production tasks, many machine plants, upon receiving a cooperative task for diesel engine parts, would give it preferential handling. The leadership unit of the Harbin electrical machinery plant took up position on the front line of production, encouraged the personnel to struggle hard, and manufactured the electrical machineries on schedule. The Shanghai steam turbine plant vigorously promoted technical innovation, studied two cogwheels at the same time, raised the processing efficiency, and assured the progress of the construction of the diesel engine.

The Great Contributions of the Scientific Research Organs

The many scientific research units and universities also undertook the study of the technical parts in the trial manufacturing of the diesel engine, entered the practical field and the work site from the schools, and cooperated in solving the technical points promptly. The crank shaft is one of the major parts of the diesel engine. According to foreign data, it is made with alloy cast iron containing nickel and chrome. The railway scientific research departments and the Dairen rolling stock plant got together, performed voluminous research and experiments based on the actual conditions of China's resources, and created new material for the crank shaft, using no nickel. The Dairen industrial college helped the Dairen rolling stock plant design and manufacture a large boring machine and solved the need of cylinder block processing for the diesel engine. The Shanghai Communication University, Pei-ching Iron and Steel College, Tientsin Industrial College, and other units also made great contributions to the trial manufacturing of the diesel engine.

The "Three-Combine" Struggle by Placing the Human Element First

For the success of the diesel engine trial manufacturing, the small directing team of the Railway Ministry stressed the importance of placing the human element first. With the prospect of long range development in mind, while they applied to the state for investment and added some necessary new equipment, they relied on the senior workers and the technicians to renovate the processing methods and remodel the equipment. During the trial manufacturing, the various plants repaired and remodelled over 300 units of all kinds of equipment, made close to 5,000 sets of processing facilities, and solved the problem of the shortage of special equipment. In addition, new processes such as the honing of the large cogwheel, the tempering of the single cogwheel, electric discharge processing, etc., were adopt-

for their trial production. The plant leadership always proceeded to the very front line, where they worked at fixed spots and directed the battle. For example, the Dairen rolling stock plant chose over 500 senior workers and technicians and more than 100 units of precision equipment, set up a diesel engine workshop, and concentrated on making the diesel engine. The original casting workshop was utilized to house the diesel workshop. Wherever possible, the men remodelled or manufactured the equipment themselves. For example, after searching the entire plant, the longest crank shaft was 1.5 m too short. So, they lengthened it and satisfied the need. They also made the connecting rod, a special processing equipment, at 1/10 the cost of imported articles. They made a total of 6 units of equipment and successfully remodelled two units. During the process of trial manufacturing, the plant party commission secretary led 15 section chiefs and over 40 essential processing and designing personnel to remain at the diesel workshop, participate in the labor, and help discover and solve the problems. The personnel of the planning, finance, supply, marketing, and dining hall units also served on the front line of production, and a great fervor was stirred up in the entire plant. The skilled workers of the diesel workshop, who were mainly responsible for the project, deployed a mass competition campaign. Each offered his own best skill. At the final contest, more than 10 items of high speed cutting experiences were collected and promoted. Thus, the processing precision of diesel engine parts was assured and the production efficiency almost tripled.

The Successful Trial Manufacturing of the Combustion Pressure Gauge, etc.

A small plant of 50 or 60 persons, with old equipment and inferior conditions, and without blueprints or special facilities, the Shanghai electrical industrial instruments plant busied itself over tens of thousands of Km, covering half of Shanghai, experimented without interruption for several months, collected the basic data by all kinds of means, and finally succeeded in trial manufacturing the high heat resistant combustion pressure gauge. The signal plant which undertook the manufacture of the electric relay broke down the old practices, improved the designing, and greatly elevated the function of the electric relay. Other railway plants also devoted a great effort and produced much result.

Cooperation of the Plants of Other Departments

The plants of metallurgical, machine, and chemical industrial departments which participated in the project, considered it their own glorious task in trial manufacturing the diesel engine, and opened the way for the birth of the diesel engine. They rendered great sup-

ed. All these were the result of the "three-combine" of the leaders, technicians, and workers. For example, the cylinder block of the diesel engine weighs 5.7 t and measures over 4 m. The processing precision of the 12 main axle sockets must be within 5 μ. By the usual way of processing, 5 large special machines are required, costing around 3 million yuan. They had to be manufactured domestically as importing them would not serve the purpose. The technicians of the Dairen rolling stock plant found the photographs of such machines in foreign explanatory material. Together with the workers, they compared, made drafts, remodelled the old equipment, and fundamentally assured the processing precision.

In the early period of the trial manufacturing, as the people lacked practical experience, many of the plans and much of the data came from foreign countries. Some items among them greatly restrained the people's creativeness. After a period, the people mastered many of the production principles, and the trial manufacturing work succeeded. To summarize their experiences, many plants deployed mass parts appraisal work since 1963. Questions and suggestions concerning the plans and equipment were brought up by the workers directly participating in production, and, under the "three-combine" method, the technical documents, equipment, and quality were appraised. Based on such appraisals, the people were mobilized, their thinking emancipated, the restraints broken, and the technical innovation of processing methods greatly improved. Some plants simplified the excessive processes, improved the measurement of the material, raised the processing efficiency many times, and greatly reduced the production cycle. The signal plant improved the design of three types of electrical relays, raised the efficiency greatly, and surpassed the level of the original foreign design. The regulating time which had required half month until now, could be done in two hours. Thus, China rapidly broke through the technical barrier in the trial manufacturing of the diesel engine, and created the condition for mass production one year in advance.

At present, China is building diesel engine production and experimental research bases. The enthusiasm is high. Talents of certain technical levels are being trained, over 100 cooperative plants are being built, and the conditions for production expansion are being prepared.

While electrification is the primary goal in China's railway enterprise, diesel-ization is the great current task. With the continuous mass production of the three types of reliable engines as the fouucation, new and world level diesel engines will be developed.